

**INDIANA DEPARTMENT OF TRANSPORTATION
MATERIALS AND TESTS DIVISION**

**CONTROL PROCEDURES FOR CLASSIFICATION OF AGGREGATES
ITM No. 203-02P**

1.0 SCOPE.

- 1.1** This method sets forth the control procedures used for the classification of aggregates. This control is accomplished through a rational system of categories and subcategories set out herein. The tests performed on ledge and production samples will be in accordance with the applicable requirements of 904.
- 1.2** These procedures will be administered to protect the interests of the Department. When unforeseen situations or interpretation difficulties arise regarding these procedures, the resolution which provides the highest quality of materials to the Department will be considered as the deciding factor.
- 1.3** All sampling and testing of production quality samples will be performed by the Department. All ledge sampling and testing will be performed by the Department or with the Department's acknowledgement an AASHTO Accredited Laboratory. Test results from an AASHTO Accredited Laboratory will be reviewed to ensure compatibility with previous test results, if applicable.
- 1.4** The final quality approval of materials for Department use will be contingent on production quality test results. Test results for other than production quality will be assigned on L rating for information only. Instances where lower classification of ledge test results has been obtained may necessitate a series of production quality samples prior to a source classification and subsequent aggregate usage approval.
- 1.5** The values stated in either acceptable English or SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore each system shall be used independently of the other, without combining values in any way.
- 1.6** This ITM may involve hazardous materials, operations, and equipment. This ITM does not purport to address all of the safety problems associated with the ITMs use. The ITM user's responsibility is to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 ITM Standards.

210 Class AP Coarse Aggregate for Concrete Pavement and Slab-on-Grade Concrete

3.0 TERMINOLOGY.

- 3.1 AASHTO Accredited Laboratory.** A laboratory which has demonstrated a proficiency in performing quality tests in accordance with the guidelines of the AASHTO ACCREDITATION PROGRAM.
- 3.2 Aggregate Specialist.** An individual qualified to evaluate various aggregate deposits based on schooling or training in Earth Sciences. This person will be approved by the Department as being qualified to perform various functions described in Department documents.
- 3.3 Category.** Source classification used to determine the production quality sampling frequency.
- 3.4 Certified Aggregate Producer (CAP).** A source that has met all of the requirements to supply materials in accordance with 917.
- 3.5 Class A.** Quality rating assigned to aggregates which meet requirements for all Department uses except concrete pavement and specified slab on grade concrete.
- 3.6 Class AP.** Quality rating assigned to coarse aggregates permitted for use in all Department concrete, in particular, concrete pavement and specified slab-on-grade concrete uses in accordance with ITM 210.
- 3.7 Classes B, C, D, E, and F.** Quality ratings assigned to aggregates with restricted uses.
- 3.8 Class G.** Quality rating assigned to materials which do not meet requirements for any Department use.
- 3.9 Core Drilling Log.** A written field description of a rock core sample and the operations.
- 3.10 Core Sample.** A rock sample obtained with a bit affixed to a barrel with drill rods that are advanced by a rotary drilling machine.
- 3.11 Finished Material.** Material which has been processed, and proposed for use.
- 3.12 Geologist.** An individual qualified to evaluate various aggregate deposits based on knowledge of the principles of geology, acquired by professional education and practical experience. This person may be employed by either the drilling consultant or aggregate source for the purpose of logging core descriptions and identifying ledges.

- 3.13 Ledge.** Any stratigraphic unit which may be separated from adjacent units by lithologic differences.
 - 3.14 Ledge Sample.** Core or face sample taken to represent ledges.
 - 3.15 New Source.** Aggregate source that has never been assigned a Department source number, or does not have past ledge and production quality test results.
 - 3.16 Point-Of-Use Sample.** Production quality sample obtained at the last opportunity prior to incorporation into the end use.
 - 3.17 Production Quality Sample.** An aggregate sample representing finished materials obtained at the aggregate source or the point of use.
 - 3.18 Source.** Facility which processes or handles aggregates. A redistribution terminal shall be classified as a source.
 - 3.19 Source Map.** A map of the quarry showing critical features and operating areas.
 - 3.20 Source Sample.** Production quality sample representing finished materials that are stored at an aggregate source or redistribution terminal.
 - 3.21 Subcategory.** Source classification based on results of tests performed on source samples and used to determine the production quality sampling frequency.
 - 3.22 Rating L.** A rating for information only.
- 4.0 SIGNIFICANCE AND USE.** This ITM will be used to assign the category and subcategory classification, if applicable, for each source, and to establish the guidelines for continued approval of sources supplying aggregates for Department use.
- 5.0 SOURCE CATEGORY AND SUBCATEGORY CLASSIFICATIONS.**
- 5.1 General.** Each source will be assigned to one or more of four categories: GS, I, II, or III. Sources assigned to categories GS, I, or II will also be assigned to one of two subcategories: A or B. The Department reserves the right to reclassify a source at such time that it is considered necessary.
 - 5.2 Category GS.** Category GS is assigned to all sources supplying gravel, natural sand, manufactured sand from sand and gravel, or slag products.
 - 5.3 Category I.** Category I is assigned to crushed stone sources whose finished products include only material from ledges with quality ratings equal to or higher than required for the proposed use, either through selective quarrying or natural occurrence.
 - 5.4 Category II.** Category II is assigned to crushed stone sources which include material from ledges with quality ratings lower than required for the proposed use in finished

materials. Category II assignment is to allow the source to include small percentages of materials from lesser quality ledges that cannot be economically removed by selective quarrying, and which will not significantly affect the results of tests performed on production quality samples. Category II assignment is not intended to allow sources to blend large amounts of lesser quality materials so that the resulting production meets higher quality specifications. Category II is assigned when it is demonstrated that the source is capable of consistently producing material of uniform quality. This capability generally is based on the results of production quality tests performed over a reasonable period of time, but in some cases may be based on a combination of ledge and production sample quality test results.

5.5 Category III. Category III is assigned to sources which meet the requirements for Category II, but have not demonstrated a capability to consistently produce uniform products. Sand and gravel, and slag sources may be classified as Category III sources if the requirements of Category GS cannot be met. A Category III assignment is to allow any source to develop a production quality history that may eventually be used to justify a Category II or GS assignment. All Category III materials are processed, stockpiled, sampled, tested, and approved prior to use of the materials. Samples will be taken and tested as the stockpile is being built. Final acceptance will be determined when the stockpile is deemed completed. The source shall not add any material to a stockpile after the final sample has been taken. Material shall not be removed from the stockpile, for non-Department use, without notification to the Department prior to shipment.

5.6 Subcategory A or B. Subcategory assignment is based on the results of tests performed on source samples. Sources with production quality test results which consistently fall in the lower 75 percent of the specification range for Class A material in accordance with Table I, are assigned to Subcategory A. Sources with multiple production quality test results which consistently fall above the 75 percent specification range for Class A material in accordance with Table I, or that have quality ratings affected by the deleterious content, are assigned to Subcategory B.

Table I
Numeric Values For 75% of the Specification Range (904.03(b))

| Department Size | Maximum Size, in.(mm) | Absorption pct. | L.A. Abrasion Loss, pct. | F.T. Loss pct.(water) |
|----------------------------|----------------------------------|----------------------------|---|--------------------------------------|
| 2 | 2 1/2 (63.0) | --- | 33.75 | 12.0 |
| 5 | 1 1/2 (37.5) | 4.50 | 30.0 | 9.0 |
| 8 | 1 (25.0) | 4.50 | 30.0 | 9.0 |
| 9 | 3/4 (19.0) | 4.50 | 30.0 | 9.0 |
| 11 | 1/2 (12.5) | 4.50 | 30.0 | 9.0 |
| 12 | 3/8 (9.5) | 4.50 | 30.0 | 9.0 |
| 43 | 1 1/2 (37.5) | --- | 30.0 | 9.0 |
| 53 | 1 1/2 (37.5) | --- | 33.75 | 12.0 |
| 73 | 1 (25.0) | --- | 33.75 | 12.0 |
| 23 | 3/8 (9.5) | --- | --- | 7.5 |
| 24 | 3/8 (9.5) | --- | --- | 7.5 |

6.0 FREQUENCY OF SAMPLING FOR TESTING.

6.1 General. The minimum frequency for ledge and production quality sampling and testing shall be as outlined within this section.

New sources proposing to provide aggregates for Department use shall submit a written request to the appropriate DMTE. The request shall include the method of sampling and other pertinent information.

Reclassification of category and subcategory assignments of existing sources will be based on a review of the test results for the ledge and production quality samples, or production quality samples only for GS sources. The source shall request reclassification in writing to the appropriate DMTE. The Department Geologist will advise the source when a quality problem exists that may necessitate reclassification.

6.2 Ledge Samples. Ledge samples are required for the following conditions:

- 6.2.1** A new source requests Department approval.
- 6.2.2** An existing crushed stone source encounters previously untested ledges.
- 6.2.3** Significant changes occur in production quality test results indicating a possible variance within existing production ledges.
- 6.2.4** At the request of the producer to evaluate selective quarrying or reassignment of previous ledge quality test results.
- 6.2.5** At such time that the Department implements a new quality control program; such as adoption of new aggregate quality specifications or tests, investigation of failed materials, or other situations which may occur.
- 6.2.6** At such time that the Department determines a significant lithologic or stratigraphic change has occurred since the last ledge or production samples were obtained and tested.
- 6.2.7** At such time that the Department determines that reactivated areas of approved crushed stone sources need to be tested.

6.3 Production Quality Samples. Production quality samples are required for the following conditions:

6.3.1 Source samples.

- (a) In conjunction with ledge samples for crushed stone sources requesting initial Department approval.
- (b) Gravel sources requesting initial Department approval.
- (c) After initial Department approval in accordance with Table II.

6.3.2 Point-of-Use samples. After initial Department approval in accordance with Table II.

6.4 Testing Location. The location of testing for ledge and production quality samples will be as follows:

- 6.4.1** Ledge samples will be tested at the Materials and Tests Division or an AASHTO Accredited Laboratory
- 6.4.2** Production quality samples that require L.A. Abrasion, absorption, and deleterious determination will be tested at the District laboratory. Production quality samples that require soundness determination will be tested at the Materials and Tests Division.

Table II
Frequency for Sampling and Testing
Source and Point-Of-Use Production Quality Samples

| <u>Category</u> | <u>Subcategory</u> | <u>Source Production Qualities</u> | <u>Point-Of-Use Production Qualities</u> |
|-----------------|--------------------|---|---|
| I | A | Every two years, Department Sizes: 2; 5, or 8; 23 or 24 NOTE: 3 | None, if all active ledges are Class A. One per year if selective quarrying and production is used to remove lesser quality materials. NOTE: 4 |
| I | B | Every year, Department Sizes: 2; 5 or 8; 23 or 24 NOTE: 3 | Two per year of any coarse size used and any fine size used. None in year when no material is used by the Department. NOTES: 2 and 4 |
| II | A | Every Year, Department Sizes: 2; 5 or 8; 43, 53 or 73; 23 or 24 NOTES: 3, Dolomites – 1 | One per quarter of any coarse size used and any fine size used. None in quarter when no material is used by the Department. NOTES: 2 and 4 |
| II | B | Every year, Department Sizes: 2; 5 or 8; 43, 53 or 73; 23 or 24 NOTES: 3 Dolomites – 1 | One per month of any coarse size used and any fine size used. None in month when no material is used by the Department. NOTES: 2 and 4 |
| III | -- | Every year, Every Stockpile | See II B |
| GS | A | Every two years, Department Sizes: 2; 5 or 8; 23 or 24 NOTE: 3 | When deemed necessary by the Department. |
| GS | B | Every year, Department Sizes: 2; 5 or 8; 23 or 24 NOTE: 3 | When Deemed necessary by the Department. |

Note 1 - Department approved dolomite sources will be sampled for 11's; 12.5 mm (1/2 in.) material

Note 2 - The selection of the size sampled should be at random at each source.

Note 3 - Size 2 will be obtained when proposed for use in HMA mixtures.

Note 4 - Stone sand 23's and 24's will be sampled at the same frequency.

7.0 LEDGE SAMPLING.

- 7.1 General.** It shall be the responsibility of the source to prepare a ledge sampling plan that is acceptable to the Department. Core sampling shall be the primary method of ledge sampling, with face sampling an allowable alternate. If unsafe conditions appear to exist, either party has the right to refuse to allow face sampling. The sampling and handling costs will be the responsibility of the source.
- 7.2 Ledge Sampling Plan.** The ledge sampling plan shall include, as a minimum, the following requirements:
- 7.2.1** The method for obtaining the ledge samples.
 - 7.2.2** Sampling locations identified on the latest available copy of the source map from the Annual Aggregate Source Report. Reef structures may necessitate sampling at predetermined mining levels.
 - 7.2.3** Compliance with applicable current Mine Safety and Health Administration regulations.
 - 7.2.4** Identification of the Source Safety Officer responsible for enforcing all safety requirements.
- 7.3 Ledge Identification.** The rock type, texture, color and bedding shall be as indicated on IT-530Q. The GSA Rock Color Chart may be used as an additional reference.
- 7.4 Core Sampling.** Core sampling shall be conducted in accordance with the following requirements:
- 7.4.1** The Department Geologist shall be notified prior to commencement of the coring operation. In the event that thin ledges are encountered with questionable ledge contacts, the DMTE shall be immediately notified if not present.
 - 7.4.2** The Department Geologist will not direct the coring operation.
 - 7.4.3** Cores shall be drilled a minimum of 30 ft (10 m) apart and represent a maximum of the equivalent of two years of production, unless otherwise approved.
 - 7.4.4** The source Geologist or Aggregate Specialist shall, in coordination with the Department Geologist, select the core locations, preliminarily identify the ledges, and determine the number of cores sufficient to obtain the required quantity of material.

A minimum of 35 lb (15 kg) of core sample shall be required for laboratory processing for each ledge. The approximate yield of a solid core per 1 ft (0.3 m) is as follows:

| <u>Nominal Core Diameter</u> | | <u>Weight (Mass) of Core</u> |
|----------------------------------|---|----------------------------------|
| 1.875 in. (47.6 mm) | = | 3.2 lb (1.45 kg) |
| 2.000 in. (50.8 mm) | = | 3.6 lb (1.63 kg) |
| 2.400 in. (61.0 mm) | = | 5.2 lb (2.36 kg) |
| 2.500 in. (63.5 mm) | = | 5.6 lb (2.54 kg) |
| 3.000 in. (76.2 mm) | = | 8.1 lb (3.67 kg) |
| 3.345 in. (85.0 mm) | = | 10.1 lb (4.58 kg) |
| 4.000 in. (101.6 mm) | = | 14.4 lb (6.53 kg) |
| 5.875 in. (149.2 mm) | = | 31.1 lb (14.11 kg) |

- 7.4.5** A minimum of three cores shall be properly taken, identified and stored.
- 7.4.6** The minimum ledge thickness for testing purposes shall be 1 ft (0.3 m).
- 7.4.7** The minimum core diameter shall be a nominal size of 1.875 in. (47.6 mm).
- 7.4.8** The source Geologist or Aggregate Specialist shall be responsible for completion of the Core Log TD-539 or other approved form, and the Ledge and Core Sample Description IT-530Q, and for the proper collecting, splitting, packaging, and shipping of the cores to the Materials and Tests Division, 120 S. Shortridge Road, Indianapolis, IN 46219.
- 7.4.9** Rock core boxes shall be weatherproof and constructed of wood or other durable materials for the protection and storage of cores while en route from the drill site to the Materials and Tests Division. All core boxes shall be provided with longitudinal separators.

Recovered cores shall be laid in the box from upper left to lower right. The top and bottom of each coring run shall be identified. Spacers, blocks, or plugs shall be marked and inserted into the core column within the separators to indicate the top and bottom of each coring run and zones of no core recovery.

Each box shall be marked on the outside to indicate the core or boring number, source number, numerical position of the box (e.g., hole X, box 2 of 7), depth of the top and bottom of the particular core run contained in that box, date of coring, possible formation and ledge contacts, and any other pertinent information.

The entire core column shall be put into the boxes and transported to a location for splitting. The split core will be reassembled and replaced in the core box in the pre-split position. The split cores shall be submitted to the Materials and Tests Division after consultation with the Department Geologist.

7.4.10 The Department Geologist will examine the split cores and core drilling logs as prepared by the source Geologist or Aggregate Specialist. The following items shall be furnished as a minimum:

- (a) The core locations and elevations identified by grid coordinate or physical feature reference as marked on the latest available source map from the Annual Aggregate Source Report. The elevation of the bore hole shall be referenced and surveyed from a bench mark that has been previously tied into a U.S.C. & G.S. bench mark or other recognized bench mark.
- (b) A detailed description of each ledge for location, thickness, rock type, color, lithology, grain size, texture, bedding characteristics, elevation to the nearest 0.1 ft (0.03 m) of the top and base of ledges, and any other pertinent observations. This information shall be indicated on IT-530Q.
- (c) Length of particular core run.
- (d) Percent recovery. This information is used to determine the material which may have been washed away or for locating voids, and is determined as follows:

$$\text{Percent Recovery} = \text{Length Recovered} / \text{Length of Core Run} \times 100$$

- (e) Name of the Geologist or Aggregate Specialist, Department representative, and quarry representative present during the coring operation. If a particular boring is not completed during a given day, the date and depth of the drilling shall be noted.
- (f) Any miscellaneous information such as loss of water from the core hole, decreased or increased effort in coring by the drilling rig, or change in color of the wash cuttings. This information shall be listed in the remarks column with the approximate depth of occurrence.

7.4.11 The wall face to be represented by the cores shall be observed by the Department Geologist prior to final ledge designation and approval.

7.5 Face Sampling. Face sampling shall be conducted in accordance with the following requirements:

- 7.5.1** The source shall provide a means for the Department Geologist to closely examine the face of the wall to be sampled.
- 7.5.2** Ledges shall be identified in accordance with 7.3
- 7.5.3** A source Geologist or Aggregate Specialist shall participate with the Department Geologist in all face sampling at the site.
- 7.5.4** The source shall provide a minimum of 180 lb (90 kg) of material for the sample.
- 7.5.5** The sample will consist of approximately 60 lb (30 kg) of representative material from each third of the identified ledge.
- 7.5.6** The Department Geologist will determine the acceptable quantity of material with concurrence of the source Geologist or Aggregate Specialist.

8.0 ANNUAL AGGREGATE SOURCE REPORT.

8.1 General. Crushed stone aggregate sources are required to submit an Annual Aggregate Source Report. Sources that are not a Certified Aggregate Producer shall submit a report in accordance with 8.2. Certified Aggregate Producers shall submit a report in accordance with 8.2.1, 8.2.2, 8.2.4, 8.2.5, and 8.2.6.

8.2 Report.

8.2.1 Format. The report shall be typed, and if maps are hand drawn they shall be in a professional manner. Limited handwritten words will be acceptable on maps and figures. The Department source number and the report date shall be noted in a consistent location on each page of the report. An example of an acceptable Annual Aggregate Source Report is included in Appendix C.

8.2.2 Title Sheet. The report shall contain a title sheet that lists the following information:

- (a) The year for which the report is being submitted.
- (b) Source name.
- (c) Source number.
- (d) Mailing address.
- (e) Phone number.
- (f) Fax number.
- (g) Names of Management and Quality Control Personnel who are responsible for reporting to the Department.
- (h) Source location identified by section, township, range, longitude, latitude, and nearest identifiable points such as highways, towns, etc.

8.2.3 Mineral Deposit Description - On a separate page an explanation shall be included for the following:

- (a) Thickness of the current working benches.
- (b) Class AP ledges and quality expiration dates.
- (c) Ledges meeting dolomite and sandstone requirements and the most recent approval dates.
- (d) Ledges requiring special handling procedures.
- (e) The Department classification.
- (f) Any significant differences in the stratigraphic section measurements and the respective ledge thickness as reported on the most recent Summary of Ledge Quality Results letter.

8.2.4 Source map. The report shall include a map of the mineral deposit. If the processing or stockpiling areas are on-site, they may be shown on the same map. If the processing or stockpiling areas are at another location, additional maps will be required. The map may be a drawing or an aerial photograph. Each map shall include the following:

- (a) **Title Block.** The map shall display a title block containing as a minimum the source name, Department source code number, and submittal or revision date.
- (b) **North Arrow.** Each map shall display a North arrow.
- (c) **Scale -** Each map shall display a scale appropriate to the size of the property or source area; however, no scale shall be less than 1 in. (25 mm) = 200 ft (60 m) and no greater than 1 in. (25 mm) = 100 ft (30 m), unless otherwise approved.
- (d) **Grid.** A grid shall be established using a rectangular coordinate system. The grid shall be indicated on the map either directly or using an overlay. The major grid lines shall be no further apart than 300 ft (100 m) and incremented at least every 75 ft (25 m) as measured on the map.
- (e) **Benchmarks.** At least one permanent benchmark shall be established on the property. All other points shall be referenced to the permanent benchmark through the true elevation. Temporary benchmarks shall also be established, and at least one shall be available for easy access to each ledge.
- (f) **Control Points.** Permanent control points for the grid shall be established within the property perimeter. There shall be enough permanent control points to permit the reestablishment of a portion of the grid within approximately one hour. The control points shall be close enough to the deposit such that all significant features can be conveniently and accurately referred to by standard survey methods.
- (g) **Quarry Walls.** All quarry walls, including the quarry outline and all active and inactive benches, shall be shown on the map. Each bench shall be discernable from other benches.
- (h) **Proposed Operating Areas.** All proposed operating areas for the year represented by the Annual Aggregate Source Report shall be clearly designated in some manner. The source is not committed to production from these areas, but shall designate the areas from which they anticipate production. The map may be revised at any time during the year if production is needed from areas that were not previously marked.
- (i) **Critical Features.** The map shall show all relative critical features including, as a minimum, the office, scales, testing laboratory, stockpile areas, processing plant areas, ramps, sumps, and pertinent quarry roads.

8.2.5 Legend. On the map or on a separate page, the source shall include a legend and map symbols appropriate to the source map.

8.2.6 Stratigraphic Section. On a separate page, the source shall include one or more source-specific stratigraphic sections. The stratigraphic sections shall be prepared to an appropriate scale to graphically and descriptively depict the stratigraphic relationships of the various lithologies within the current or anticipated production benches. Each stratigraphic section shall include, as a minimum, the following requirements:

- (a) The grid coordinates near where the section was measured.
- (b) The lithologies above and below the current or anticipated production bench.
- (c) The Department ledge numbers with the thickness, geologic formations and members names, elevation, and date of measurement given for the top of each bench.

8.3 Submittal. No later than April 1st of each year, each source shall submit an Annual Aggregate Source Report to the appropriate DMTE. Failure to submit an Annual Aggregate Source Report shall result in rejection of the source to provide materials for Department use until such time that an acceptable report has been received by the DMTE.

Upon receipt of the report, the District Geologist will verify the contents of the report by field review with the Producer's representative designated in 8.2.2. A summary of this review will be forwarded with a signed cover letter from the DMTE to the Field Control Section of Materials and Tests Division. The District will retain one copy and forward another copy of the report to the Assistant Quality Assurance Engineer for incorporation into the source QCP Appendix, if applicable. The source shall retain and include the report in their copy of the QCP, if applicable.

APPENDIX A
LEDGE AND CORE SAMPLE DESCRIPTION

IT-530Q
Rev. 10/98

INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS & TESTS
LEDGE AND CORE SAMPLE DESCRIPTION

Date Sampled

YEAR LAB SUBMITTER SEQUENCE

Sampled By

SOURCE

LOCATION

AREA FROM GRID MAP

X COORDINATE

Y COORDINATE

Section Township N or S

Range E or W

LEDGE INFORMATION

LEDGE NO. 52

LEDGE THICKNESS 53
(0.01 m)

ELEV.- Top ledge 54
(0.01 m)

ELEV.- Bottom 55

COLOR

SELECT PREDOMINATE GSA COLOR CODE

WET or DRY Surface
(Circle one)

STRATIGRAPHY

SYSTEM

72 2

FORMATION

74 2

MEMBER / BED

73 2

COLOR 75 2 5

BEDDING (Ingram 1954)

(Check The Three Prominant Characterisitics)

- | | | |
|------------------------|----------------------------|-----------|
| 51 ___ Steeply Dipping | 66 ___ Discontinuous | |
| 52 ___ Crossbedded | 67 ___ Very Thickly Bedded | >1m |
| 56 ___ Contorted | 68 ___ Thickly Bedded | 30-100 cm |
| 61 ___ Wavy | 69 ___ Medium Bedded | 10-30 cm |
| 62 ___ Pinch & Swell | 70 ___ Thinly Bedded | 3-10 cm |
| 63 ___ Irregular | 71 ___ Very Thinly Bedded | 1-3 cm |
| 64 ___ Lenticular | 72 ___ Thickly Laminated | 0.3-1 cm |
| 65 ___ Planar | 73 ___ Thinly Laminated | < 0.3 cm |

GRAIN SIZE 76 2

ROCK TYPE 77 2

- | | |
|-------------------|-------------------|
| 001 ___ Limestone | 004 ___ Chert |
| 002 ___ Dolostone | 005 ___ Shale |
| 003 ___ Sandstone | 006 ___ Siltstone |

CRYSTAL SIZE 79 2

GRAIN SIZE (Udden-Wentworth)

(Select One)

- | | | | |
|---------------------|------------|-------------------|------------------|
| 014 ___ Cobbles | >64 mm | 019 ___ Medium | 0.5-0.25 mm |
| 015 ___ Pebbles | 64-4 mm | 020 ___ Fine | 0.25-0.125 mm |
| 016 ___ Granular | 4.0-2.0 mm | 021 ___ Very Fine | 0.125-0.0625 mm |
| 017 ___ Very Coarse | 2.0-1.0 mm | 022 ___ Silt | 0.0625-0.0039 mm |
| 018 ___ Coarse | 1.0-0.5 mm | 023 ___ Clay | < 0.0039 mm |

CRYSTAL SIZE (Folk 1961)

(Select One)

- | | |
|---------------------------|---------------|
| 024 ___ Extremely Coarse | >4.0mm |
| 017 ___ Very Coarse | 4.0-1.0mm |
| 018 ___ Coarse | 1.0-0.25mm |
| 019 ___ Medium | 0.25-0.062mm |
| 020 ___ Fine | 0.062-0.016mm |
| 021 ___ Very Fine | 0.016-0.004mm |
| 025 ___ Aphanocrystalline | <0.004mm |

LITHOLOGY (Check The Four Prominant Characterisitics)

- | | | | | |
|----------------------|---------------------|----------------------|-------------------------|-----------------------|
| 01 ___ Cherty | 12 ___ Arenaceous | 23 ___ Conglomeritic | 34 ___ Micritic | 44 ___ Siliceous |
| 02 ___ Clay Pocketed | 13 ___ Gypsiferous | 24 ___ Coralline | 35 ___ Mod. Sorted | 45 ___ Silty |
| 03 ___ Fossiliferous | 14 ___ Glauconitic | 25 ___ Crystalline | 36 ___ Mottled | 46 ___ Skeletal |
| 04 ___ Pelletal | 15 ___ Vuggy | 26 ___ Dense | 37 ___ Pisolitic | 47 ___ Sparry |
| 05 ___ Petroliferous | 16 ___ Iron Stained | 27 ___ Ferriferous | 38 ___ Poorly Indurated | 48 ___ Stromatolitic |
| 06 ___ Pyritic | 17 ___ Stylolitic | 28 ___ Fissile | 39 ___ Poorly Sorted | 49 ___ Sucrosic |
| 07 ___ Oolitic | 18 ___ Algal | 29 ___ Flaggy | 40 ___ Porous | 50 ___ Variegated |
| 08 ___ Argillaceous | 19 ___ Bioclastic | 30 ___ Friable | 41 ___ Reefal | 51 ___ Vitreous |
| 09 ___ Weathered | 20 ___ Blebby | 31 ___ Intraclastic | 42 ___ Rubbly | 52 ___ Well-Indurated |
| 10 ___ Dolomitic | 21 ___ Brecciated | 32 ___ Lithographic | 43 ___ Shaly | 53 ___ Well-Sorted |
| 11 ___ Calcareous | 22 ___ Carbonaceous | 33 ___ Micaceous | | |

LITHOLOGY 85

BEDDING 86

APPENDIX B
AGGREGATE CORE BORING LOG

**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS
AGGREGATE CORE BORING LOG**

State Form 45230 (2-92)

APPENDIX C
ANNUAL AGGREGATE SOURCE REPORT
(EXAMPLE)

EXAMPLE

AGGREGATE SOURCE REPORT

TITLE SHEET

| | |
|----------------------|------------------------|
| <u>Producer Name</u> | Limerock Quarries Inc. |
| <u>Address</u> | P.O. Box 7-11 |
| <u>City, State</u> | Markle, IN 47025 |
| <u>Phone #'s</u> | 219-328-7025 |
| <u>Fax</u> | 219-244-7025 |

1999
Annual Aggregate Source Report

Limerock Quarries Inc.
Markle Plant

INDOT Source #2799

Prepared For **INDOT**
Materials & Tests Division
120 S. Shortridge Rd.
Indianapolis, IN 46219-0389

Date Submitted
March 1, 1999

| | |
|--------------------------|---|
| <u>Source Location:</u> | Section 11; T 27 N, R 10 E; 2.3 miles South of Markle, IN. One mile West of SR 3. Wells County; Longitude W 85°21'40", Latitude N 40°48'00" |
| <u>Regional Manager:</u> | Clay Mudstone |
| <u>Superintendent:</u> | Ferris Ore |
| <u>Quality Control:</u> | Richard Quality & Crystal Stone |

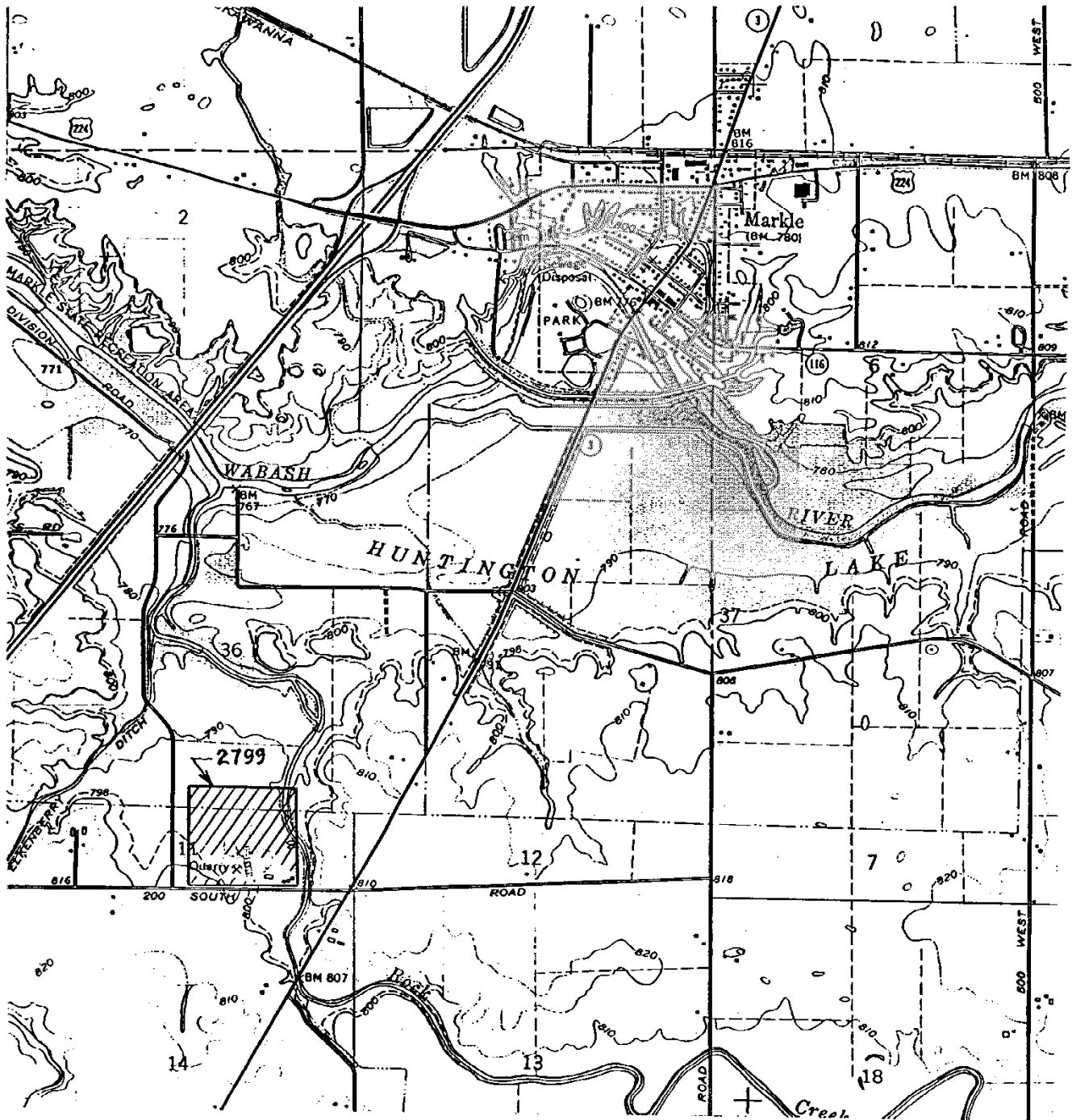
1/7
Source #2799
1-15-99

It is the intention of this report to satisfy the needs of Indiana Test Method (ITM) 203-99P, Section 8.0.

This source currently operates two open-pit benches. The upper bench is mined for commercial purposes only and consists of Ledges 1 and 2. This bench is approximately 60 feet thick. Ledge 3 is Waldron Shale and is wasted. the lower bench (Ledges 4 and 5) is approximately 73 feet thick, is classified as Category IA, and is INDOT Class AP approved up to March 15, 2001. Ledge 5 has a Magnesium content of 10.8 and is Dolomite Approved by INDOT.

Elevations for all benches may be found on the following geologic cross-section. A benchmark with an elevation of 800.82 is located next to the office, which is southeast of the quarry. The proposed 1999 operating areas may be found on the following Source Map. Also included is the location map and quarry map indicating the stockpile areas. The symbol Legend and a Stratigraphic Description for this source are shown on the last two pages.

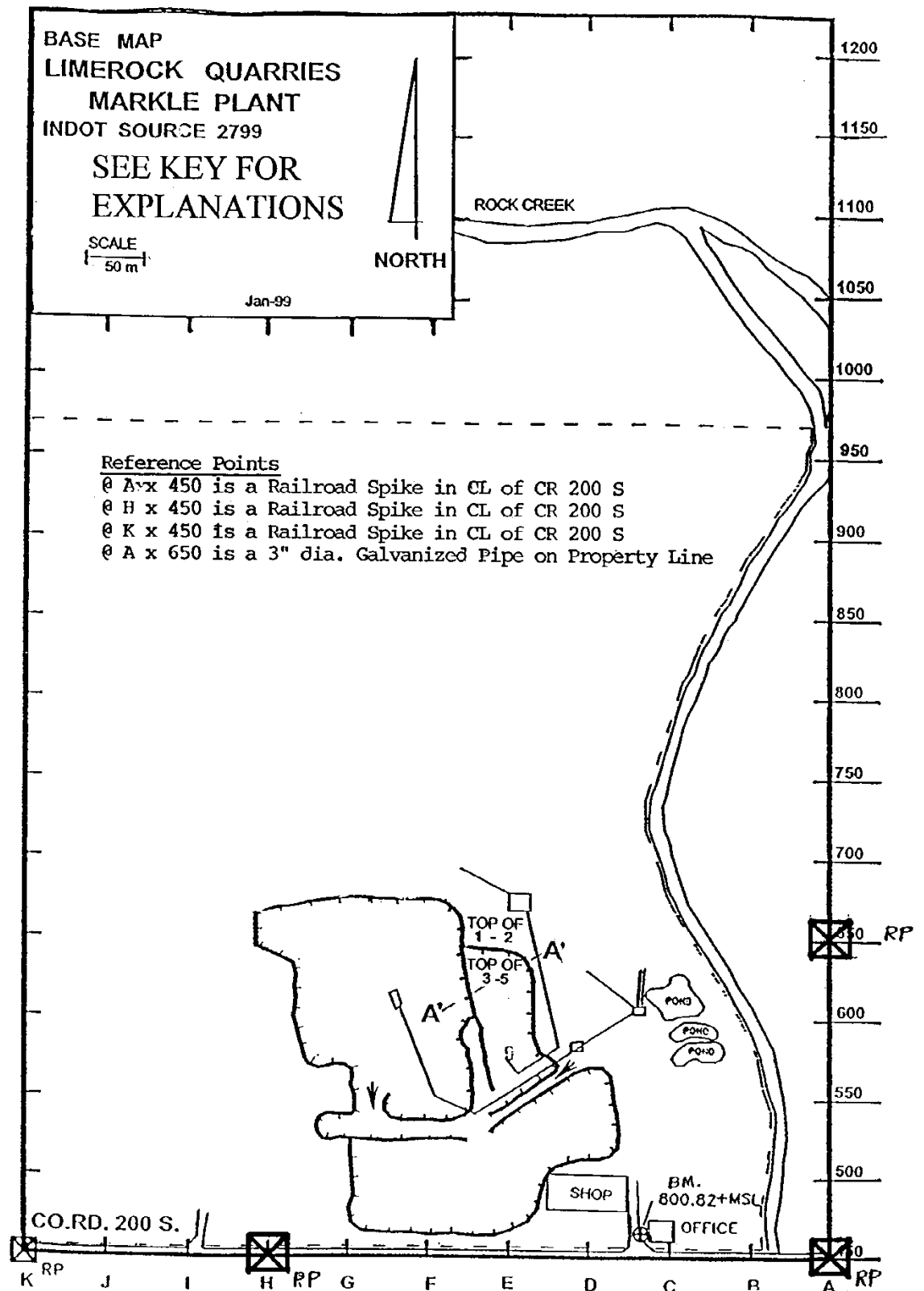
2/7
Source #2799
1-15-99

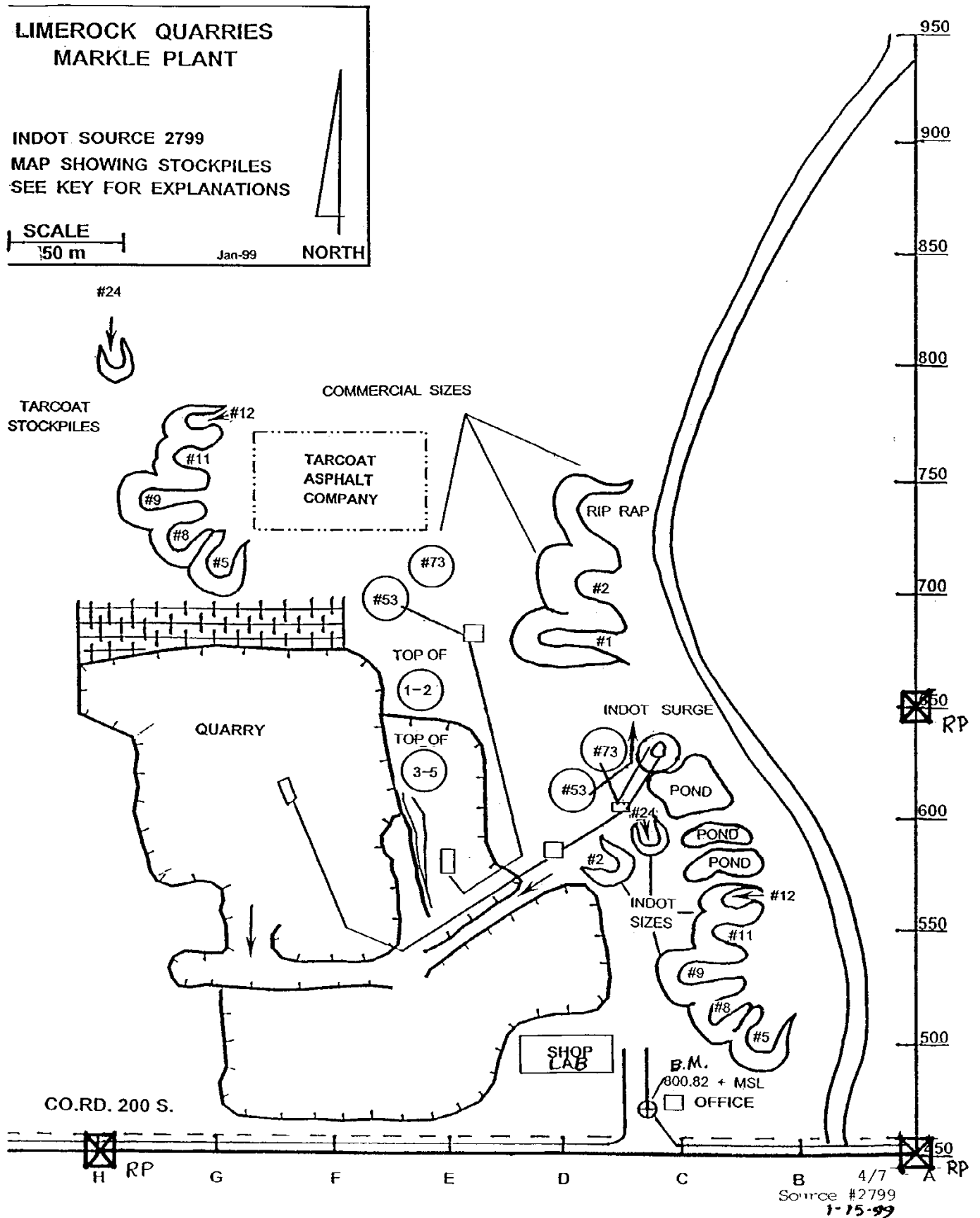


LOCATION MAP FOR LIMEROCK QUARRIES, INC.-MARKLE PLANT






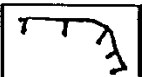
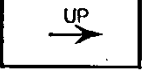
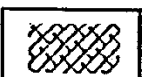
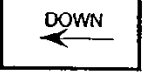


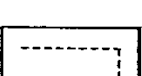
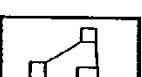
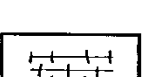

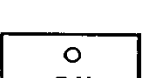

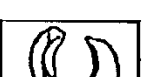
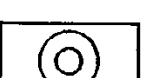
3/7
Source #2799
1-15-99

NORTH



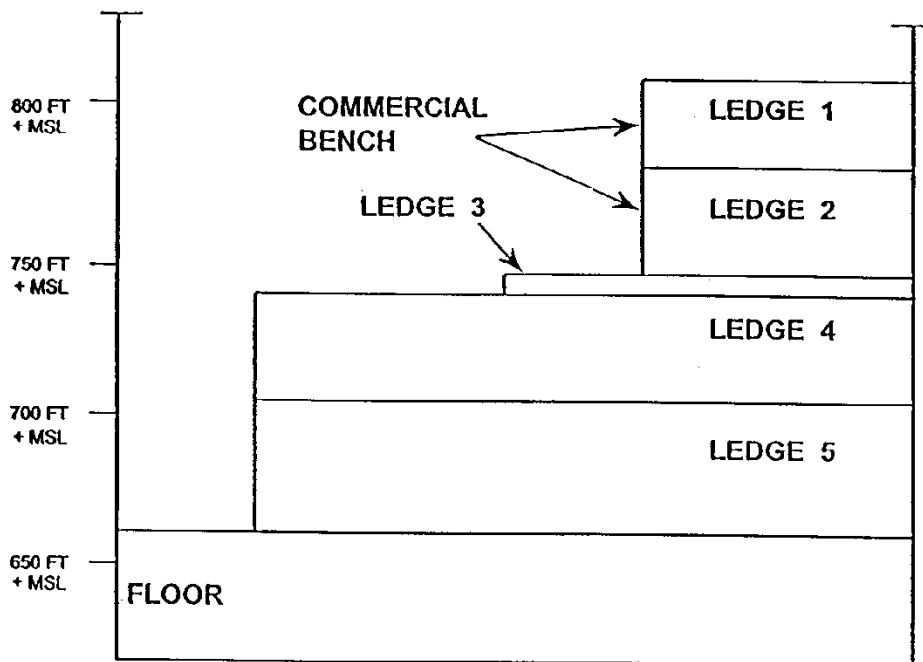


KEY TO QUARRY MAP FOR INDOT LIMEROCK QUARRIES, INC. MARKLE PLANT # 2799

| SYMBOL | EXPLANATION | SYMBOL | EXPLANATION |
|---|-----------------------|---|---|
|  | PERMANENT BENCHMARK |  | TAILINGS / FILL |
|  | TEMPORARY BENCHMARK |  | WATER BODIES |
|  | REFERENCE POINT |  | QUARRY WALLS HANCHURES ON LOWER SIDE |
|  | RAMP ARROW - UP |  | PROPOSED QUARRY AREA FOR CURRENT YEAR |
|  | RAMP ARROW - DOWN |  | ROADS |
|  | BUILDINGS |  | PROPERTY LINES |
|  | PLANT STRUCTURES |  | PROPOSED OPERATING AREA FOR CURRENT YEAR |
|  | INDOT STOCKPILES |  | CORE HOLE |
|  | COMMERCIAL STOCKPILES | | |
|  | MISC. STOCKPILES | | |
|  | SURGEPILES | | |

STRATIGRAPHIC DESCRIPTION FOR LIMEROCK QUARRIES, INC. MARKLE PLANT #2799

CORE LOCATIONS F - 10 x 600 & E x 650



| LEDGE | THICKNESS | GEOLOGIC FORMATION |
|-------|-----------|--------------------|
| 1 | 20' | LISTON CREEK |
| 2 | 40' | MISSISSINEWA |
| 3 | 5' | WALDRON |
| 4 | 35' | LOUISVILLE |
| 5 | 38' | LIMBERLOST |

MARKLE PLANT - # 2799

* LEDGES 4 & 5 ARE AP APPROVED ; EXPIRES 12/12/99

* THIS SOURCE HAS AN INDOT IA CLASSIFICATION

* LEDGE #5 IS APPROVED DOLOMITE (10.8 Mg.)